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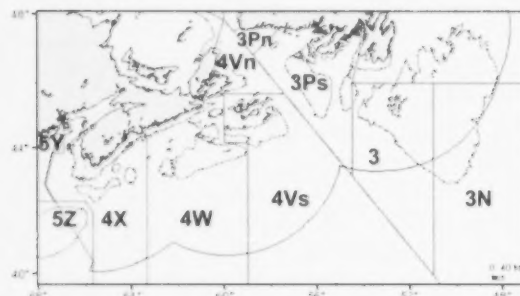
Science

Sciences

Maritimes Region

Canadian Science Advisory Secretariat  
Science Advisory Report 2006/038

## ATLANTIC HALIBUT ON THE SCOTIAN SHELF AND SOUTHERN GRAND BANKS (Div. 3NOPs4VWX)



Management unit definition (3NOPs4VWX5Zc).

### Context

Atlantic halibut (*Hippoglossus hippoglossus*) is the largest of the flatfishes and ranges widely over Canada's East Coast. The management unit definition (3NOPs4VWX5Zc) is based largely on tagging results that indicated Atlantic halibut move extensively throughout the Canadian North Atlantic with smaller fish moving further than larger fish.

Landings of Atlantic halibut have been recorded since 1883, and until 1988 the Atlantic halibut fishery was not regulated by total allowable catch (TAC). An industry / DFO longline halibut survey on the Scotian Shelf and Southern Grand Banks (3NOPs4VWX) was initiated in 1998 to provide estimates of abundance and distribution for Atlantic halibut, which provide input for assessment conducted on an annual basis.

While the DFO research vessel (RV) survey is thought to provide information on incoming recruitment (< 81cm), estimates of adult (≥81cm) abundance are considered unreliable; consequently, the industry survey is critical to the assessment of this fishery. The industry survey provides an indicator of the direction of change in abundance of the halibut population for the Scotian Shelf and Southern Grand Banks, and also provides estimates of population size structure, including indications of incoming recruitment.

A framework assessment is anticipated within the next two years.

### SUMMARY

- There is no indication of a change in distribution from the industry / DFO longline halibut survey information.
- Overall, there appears to be relative stability in the adult population of 3NOPs4VWX Atlantic halibut within the fixed station phase of the survey.
- The size composition of halibut from the survey indicates there has been no depletion of large fish from the population.

August 2006

Canada

- The commercial index catch rate shows a decline from 2002 to 2004; this phase of the survey is, however, more complex and not all sources of variability have been considered at this point.
- Numbers of pre-recruits from the fixed station phase of the survey declined from 2001 to 2004; there is some uncertainty over the 2005 data point.
- The results of the Atlantic halibut aging study will provide a better understanding of the population status, and are anticipated for 2007.
- There is no basis to advise a change in the current fishing levels for 2006-07.

## INTRODUCTION

Halibut are demersal, living on or near the bottom, at temperatures within a few degrees of 5°C. Atlantic halibut are most abundant at depths of 200-500 m in the deep-water channels running between the banks and along the edge of the continental shelf, with larger individuals moving into deeper water in winter. The management unit definition (3NOPs4VWX5Zc) was based largely on tagging results that indicated that Atlantic halibut move extensively throughout the Canadian North Atlantic with smaller fish moving further than larger fish. Migrations of larger fish are thought to be related to spawning. Studies have shown that the Browns Bank area may be an important rearing area for juvenile halibut and that there is a north-eastward movement of fish as they grow. The geographic range of Atlantic halibut in the Northwest Atlantic extends from the coast of Virginia in the south to the waters off Disko Bay, Greenland in the north. Since the early 1990s, there appears to have been a significant reduction in the numbers of halibut in the northern portion of this range, especially along Labrador Shelf.

Although the growth and maturity cycles of Atlantic halibut require further study, it appears that females grow faster than males, and attain a much larger maximum size. Females reach 50% maturity at about 115cm, while males reach 50% maturity at about 75cm. In the absence of reliable growth information, age at maturity remains uncertain. Halibut are voracious feeders and up to a length of 30cm, food consists almost exclusively of invertebrates. Between 30cm and 66cm, both invertebrates and fish are consumed, while halibut over this size eat fish almost exclusively.

The halibut fishery catches halibut as part of a suite of species, which includes most notably, white hake, cusk, and cod. The relative proportions of these vary with location and time of year. An industry / DFO longline halibut survey on the Scotian Shelf and Southern Grand Banks was initiated in 1998 to provide estimates of abundance and distribution for Atlantic halibut. The survey consists of two phases: a fixed station phase and a commercial index phase.

The fixed station phase of the survey utilizes a stratification system designed to produce a stratum-weighted estimate of mean catch rate, where strata have been based on the distribution of observed landings by trip for the period 1993 – 1997. Three strata were defined using high (> 250 kg), medium (50 – 249 kg) and low (<49 kg) landings. The area of each stratum was estimated using potential mapping with a radius of influence for each observation sufficient to define a stratum for all areas of the survey area. During the fixed station phase, pre-selected locations are fished using prescribed survey fishing protocols (hook-size, number of hooks, and minimum soak times).

During the commercial index phase, participants fish with their own fishing protocols and locations of their choosing (Zwanenburg and Wilson, 2000; Zwanenburg and Wilson 2003; for detailed description of survey protocols). The results of this survey form the basis of this report.

### **Rationale for Assessment**

Advice was requested by Fisheries Management on the stock status of 3NOPs4VWX to determine a TAC consistent with the management plan.

- What are the current removals, including surveys, and commercial bycatch of Atlantic halibut?
- What are the recent catch rate and distribution trends from the Atlantic halibut industry survey?
- Evaluate whether or not these trends indicate positive or negative stock status. Report on these trends for small (<81cm) and large (≥81cm) fish.

### **The Fishery**

Landings of Atlantic halibut have been recorded for the east coast of Canada since 1883. The long-term average landings for this region have been approximately 1900t annually. Until 1988, the fishery was not regulated by TAC (Figure 1). In 1988, TAC management was introduced and a TAC was set at 3200t. The TAC was reduced in 1995 to 1500t, followed by a further reduction in 1996 to 850t. Landings to date (February 09, 2006) for the 2005-06 fishing season are 989t (Table 1).

In 1999, the FRCC recommended an increase to the TAC for this stock from 850 to 1000t; two further increases were implemented to achieve the present TAC level of 1375t.

The management unit (3NOPs4VWX5Zc) is based largely on tagging results that indicated Atlantic halibut move extensively throughout the Canadian North Atlantic. Within the management unit, halibut is fished nearshore and offshore mainly by longliners using bottom hook-and-line gear. Since 1994, management plans and license conditions require the release of halibut less than 81cm.

Since DFO RV survey estimates of adult (≥81cm) abundance are considered unreliable, an industry / DFO longline halibut survey was initiated in 1998 to provide estimates of abundance and distribution for Atlantic halibut on the Scotian Shelf and Southern Grand Banks (3NOPs4VWX). Catches for each phase of the survey are shown in Table 2.

Table 1: Total reported landings (t) of Atlantic halibut from 3NOPs4VWX5Zc. Canadian landings only from 2000 to present.

|                                 | Avg     | Avg     | Avg <sup>1</sup> | Avg <sup>2</sup> |                   |                   |      |                     |                     |                    |
|---------------------------------|---------|---------|------------------|------------------|-------------------|-------------------|------|---------------------|---------------------|--------------------|
| Sub Areas/Divisions             | 1960-69 | 1970-79 | 1980-89          | 1990-99          | 2000 <sup>3</sup> | 2001 <sup>3</sup> | 2002 | 2003                | 2004                | 2005               |
| TAC (3NOPs4VWX5Zc) <sup>4</sup> |         |         |                  | 1855             | 1000              | 1150              | 1150 | 1300                | 1300                | 1375               |
| 3NOPs                           | 996     | 488     | 957              | 487              | 307               | 503               | 483  | 236                 | 225                 | 161                |
| 4VWX                            | 1464    | 850     | 1561             | 820              | 540               | 760               | 765  | 807                 | 866                 | 670                |
| 5YZ                             | 225     | 104     | 133              | 36               | 7                 | 13                | 13   | 17                  | 19                  | 18                 |
| 3NOPs4VWX5Zc Landings           | 2685    | 1442    | 2651             | 1343             | 854               | 1276              | 1251 | 1410 <sup>4,5</sup> | 1298 <sup>4,5</sup> | 989 <sup>4,5</sup> |

<sup>1</sup> Landings prior to 1999 based on January - December calendar year

<sup>2</sup> 1999 landings based on 15 months: January 1999 - March 2000

<sup>3</sup> Landings from 2000 onwards based on April - March fishing year

<sup>4</sup> The Industry / DFO longline survey quota is included in the landings but is not counted against the TAC

<sup>5</sup> Total landings are from the Canadian Atlantic Quota Report (CAQR); landings for the subareas are from MARFIS

Table 2: Industry / DFO Atlantic halibut longline survey catches (t).

| Year          | 1998 | 1999 | 2000  | 2001 | 2002 | 2003 | 2004 | 2005 |
|---------------|------|------|-------|------|------|------|------|------|
| Fixed Station | 11.8 | 8.6  | 10.6  | 8.9  | 9.3  | 9.0  | 10.6 | 9.5  |
| Comm. Index   | 72.6 | 70.0 | 89.6  | 77.7 | 79.5 | 78.7 | 85.9 | 57.3 |
| Total         | 84.5 | 78.6 | 100.2 | 86.6 | 89.0 | 87.6 | 96.6 | 66.7 |

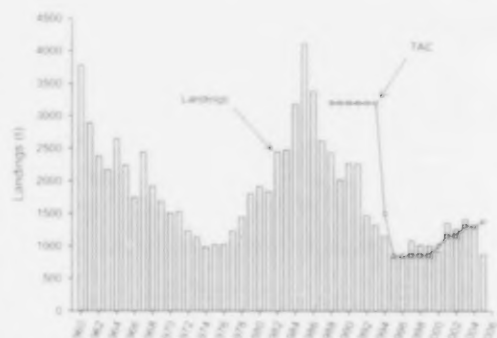


Figure 1. Landings and TAC for 3NOPs4VWX5Zc Atlantic halibut.

## ASSESSMENT

### Stock Trends and Current Status

Survey coverage in sub area 3NOPs has been inconsistent throughout the survey period; consequently analyses have been performed on data from sub area 4VWX.

Three analyses were used to examine the catch rate of Atlantic halibut in the fixed station phase of the survey, and all showed stable trends throughout the survey period (Figure 2).

The catch rates for the three strata have shown some variability from year to year, but overall tend toward stability. There has been a decline in the catch rate of Atlantic halibut in the commercial index phase the survey from 2001 to 2004, followed by a slight increase in 2005 (Figure 3).

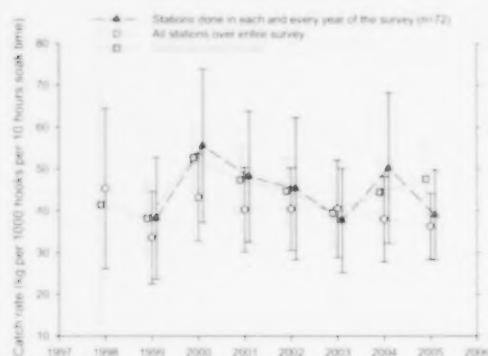


Figure 2. Fixed stations catch rates for 4VWX.

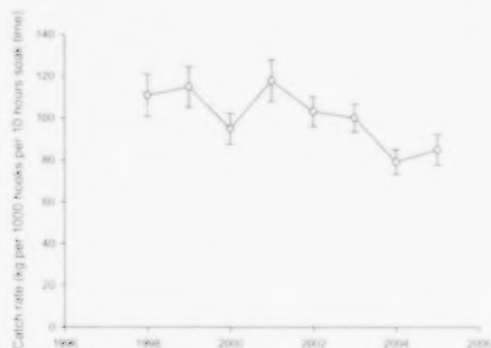


Figure 3. Commercial index catch rates for 4VWX.

Although there has been variability in the survey coverage, there is no obvious indication of a change in Atlantic halibut distribution within the survey area (Figures 4 and 5).

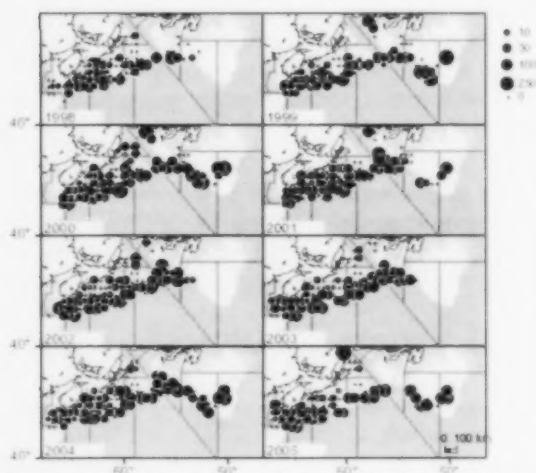


Figure 4. Fixed station catch distribution. Circles in legend indicate total average weight (kg).

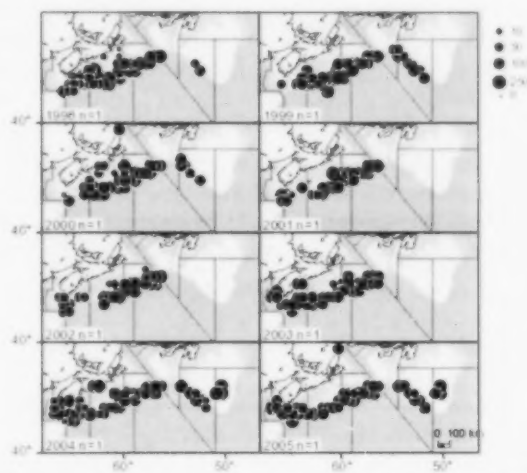


Figure 5. Commercial index catch distribution. Circles in legend indicate total average weight (kg).

The pre-recruit index (<81cm) from the fixed station survey declined from 2001 to 2004, and the most recent values remain lower or about average, depending on the stations included in the calculation. Fishable sizes ( $\geq 81$ cm) remain stable over the survey period (Figure 6).

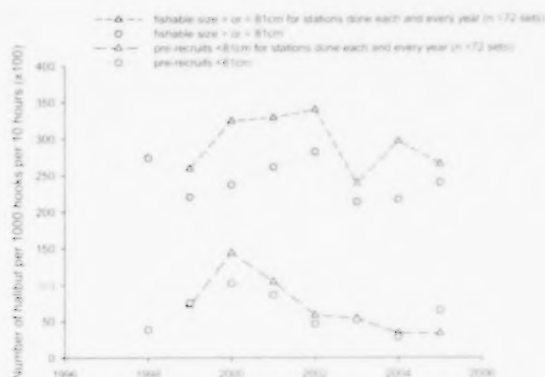


Figure 6. Fixed station catch rates (number) for 4VWX stations separated into pre-recruit (<81cm) and fishable (≥81cm) size classes.

The size composition of adult halibut caught in both phases of the Industry / DFO Atlantic halibut longline survey can be described by the median length (50<sup>th</sup> percentile) and the 95<sup>th</sup> percentile. In both the fixed station and commercial index phases of the survey, there is no evidence of a decline in the 95<sup>th</sup> percentile over the time series, indicating that there has been no loss of large fish from the population (Figures 7 and 8).

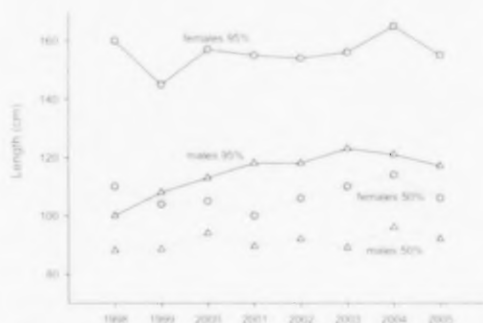


Figure 7. Size composition of halibut caught in the 4VWX fixed station phase, expressed as the median (50%) and 95th percentiles.

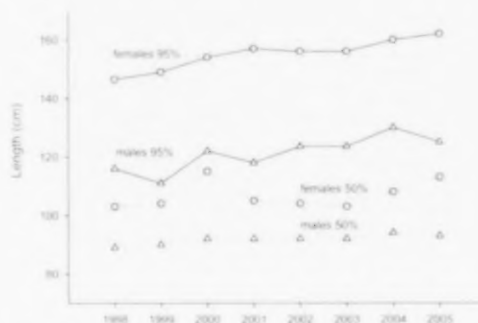


Figure 8. Size composition of halibut caught in the 4VWX commercial index phase, expressed as the median (50%) and 95th percentiles.

### Sources of Uncertainty

Survey coverage in NAFO sub area 3NOPs has not been conducted consistently throughout the survey period, consequently, advice for 3NOPs is based on analyses for data from sub area 4VWX. Also, due to fishing restrictions, insufficient survey coverage of subdivision 3Ps precludes an understanding of halibut abundance in 3Ps.

Over the course of the survey, station coverage in the fixed station phase has been irregular. Of approximately 220 stations, only 72 have been completed in all years of the survey. To understand the influence that intermittent station sampling has had on fixed station pre-recruitment estimates, several types of analyses need to be conducted. The pre-recruitment data has undergone two of three analyses; the third, most rigorous analysis (general linear

model regression analysis) is still required. This final analysis on pre-recruitment data may clarify contradictory trajectories seen in 2005 pre-recruitment using the first two analyses (Figure 6).

The fixed station and commercial index catch rate trajectories are not entirely in agreement. The disparity between the two catch rates indices might be explained by examining factors affecting commercial index catch rate. It is speculated that commercial index catch rate may be affected by fishery operations not currently accounted for in the analytical stage, such as changes in skippers, number of crew, amount of gear in the water, an increase in soaktime in 2004 and 2005, and a shift in effort within NAFO area.

A suggestion that halibut caught near the borders of the 3NOPs4VWX5Zc management unit may belong to other management units (i.e. sub area 4RST) provides reason to develop a more precise definition of the boundaries of the 3NOPs4VWX5Zc halibut management unit.

## **ADDITIONAL STAKEHOLDER PERSPECTIVES**

Participants continue to maintain a strong belief that a 21% decrease in commercial index catch in 2004 and 2005 may have been affected by factors related to fishing operations that are not effectively considered in the analytical stage. A thorough consideration of these concerns should be executed.

The continued operation of the Industry / DFO longline survey to effectively monitor population status is essential to the management of this fishery. It is also vital that the survey consistently covers 3NOPs. At present, bycatch restrictions preclude operation of the commercial index phase in 3Ps. Fishermen observed a relatively warm bottom temperature and suspect it may have had a negative effect on the catch rate in the 2005 commercial fishery.

## **CONCLUSIONS AND ADVICE**

There is no indication of a change in distribution from the survey information. Overall there appears to be relative stability in the adult population of 3NOPs4VWX Atlantic halibut within the fixed station phase of the survey. The size composition for both the fixed station and commercial index phases of the survey indicates there has been no depletion of large fish from the population over the survey time series. The commercial index catch rate shows a decline from 2002 to 2004; however this phase of the survey is more complex and not all sources of variability have been considered at this point. The number of pre-recruits from the fixed station phase of the survey declined from 2001 to 2004; however, there is some uncertainty over the 2005 data point. Results emerging from the Atlantic halibut aging study will provide a better understanding of the population status, and are anticipated for 2007. There is no basis to advise a change in the current fishing levels for 2006-07.

## **OTHER CONSIDERATIONS**

There are concerns over a reduction in the number of sets completed in 2005 when compared to previous years. A recent reduction in participation has been a result of increased cost of fishing operations, including higher fuel, bait, and labour costs, but not a similar increase in the sale price of halibut. This industry survey is critical to the assessment of this fishery. The importance of maintaining the stations that have been sampled every year can not be overemphasized, and increasing the number of stations occupied annually can only serve to increase the robustness of the survey.

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ISSN 1480-4913 (Printed)

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## **CORRECT CITATION FOR THIS PUBLICATION**

DFO. 2006. Atlantic Halibut on the Scotian Shelf and Southern Grand Banks (Div. 3NOPs4VWX). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/038.

